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PETROLOGICAL ABSTRACTS AND REVIEWS

ALBERT JOHANNSEN

HARKER, ALFRED. *Petrology for Students.* Cambridge, 1919, 5th ed. Pp. 300, figs. 100.

A comparison of the fifth with the fourth edition of Harker's book shows the chief change to be that practically all of the American examples have been "improved out." With the exception of one chapter where nephelite- and leucite-syenites are now separated from the syenites, the two editions could be used in the same class, for though the pagination is different, the different paragraphs can be easily located. The change of the chapter heading "Diabase" to "Dolerite" will not be considered an improvement in this country. Both terms are bad, in that each has two meanings; the former being used for ophitic dike-rocks of the composition of gabbros as well as for Paleozoic basalts, the latter, originally for coarse-grained basalts, now according to British usage for the rocks we call diabase. Harker still clings to the classification of diorite as a hornblende-bearing rock (p. 63) while gabbros are defined as "characterized by pyroxenes in place of hornblende" although he recognizes the modern tendency in classifications when he says: "The distinction between the hornblende- and augite-bearing types is rather an artificial one. It was established before the strong tendency of augite to pass over into hornblende was thoroughly appreciated." Also, "The family as so defined cannot be regarded as a natural one." The feldspar of diorite is given as "andesine or labradorite or exceptionally a more basic variety," while in gabbros it is given as "labradorite, with exceptionally one more acid and occasionally orthoclase."

HIRSCHWALD, J. *Leitsätze für die praktische Beurteilung, zweckmässige Auswahl und Bearbeitung natürlicher Bausteine.* Berlin, 1915. Pp. 36, figs. 18.

This book was primarily written for stone-workers and aims at giving the most important points needed in the selection and judging of building-stone. There is a short classification of rocks giving the desirable and undesirable characteristics of each, a chapter on the examination of stone quarries with examples of written forms for describing quarries, and chapters on the essentials of stone-testing, advantageous modes of working and using certain rocks with reference to schistosity, cleavage, etc., various uses of different kinds of stone, etc.

HOLMES, ARTHUR. *The Nomenclature of Petrology.* London, 1920. Pp. 284.

This little book is intended as an English substitute for Loewinson-Lessing's *Lexique Pétrographique,* which is now about twenty years old. It is a very convenient and useful volume, giving in brief form, definitions of most of the common terms used in petrology. The only fault that might be found with it is that it is too brief, and that the references are, in many cases, not to the work in which the term was originally given, but usually to later British authors. In other cases references are hard to find; for example, the reference for the source of umptekite is under "chibinite," and maenaite under "grorudite," but this can hardly be called satisfactory, especially since no hint is given as to the terms under which they may be found. Other references, such as "Syenodiorite, Evans, 1916," etc., are too incomplete to be traced. On the whole, however, the book is very good, and it is likely to prove useful to students by giving them the means for quickly finding unfamiliar terms.

HOLMES, ARTHUR. *Petrographic Methods and Calculations.* London, 1921. Pp. 515, figs. 83, pls. 4.

Quite different from previously published books on petrographic methods is this one by Holmes, in that very little space is devoted to optical methods. The author says in his preface, "I have tried to produce a more evenly balanced treatise which should penetrate the petrological domain, and not merely skirt its border land." Chapter i deals with Petrology, its scope, aims, and application, chapter ii with specific gravity, chapter iii (40 pp.), separation of minerals by heavy liquids, magnet, etc., chapter iv (52 pp.), optical examination of minerals, including not only optical properties but tables for the determination of minerals, chapter v (71 pp.), the examination of detrital sediments, chapter vi (19 pp.), the preparation of thin sections, chapter vii (45 pp.), microchemical and staining methods, chapter viii (38 pp.), the examination of thin sections, including a discussion of the Rosiwal and similar methods, genesis of minerals, saturated and unsaturated minerals, etc. Incidentally it is stated that "Johannsen has suggested the use of a planimeter for measuring areas of particular minerals on a drawing of a thin section made with the aid of a camera lucida. The procedure is more complicated and tedious than the ordinary linear method now in general use." But in the method mentioned no camera lucida drawing is made and the time required is less than a fourth of that of the Rosiwal. Chapter ix deals with rock textures, chapter x with chemical analyses and their interpretation and includes a discussion of the C.I.P.W. system, and chapter xi with graphical representation of chemical analyses. The book thus brings together much of the miscellaneous data so often needed by the petrographer. It will therefore be examined with interest and profit by all advanced workers in the science.

HOMMEL, W. "*Systematische Petrographie auf genetischer Grundlage,*" Vol. I, *Das System.* Gebrüder Borntraeger, Berlin, 1919. Pp. xii+174, figs. 5, pls. 5.

Hommel proposes a double-barreled system of classification, in that he represents a rock by a formula composed of two parts. The first, which he calls his "Molekularformel," is derived directly from the chemical analysis and represents the molecular proportions of the various oxides. The second, or "Konstitutions formel," represents the percentages of certain minerals calculated from the chemical analysis. The percentages of the computed minerals, however, resemble those of the normative minerals of the C.I.P.W. system. since they generally do not represent the amounts actually present in the rock. As in the C.I.P.W. system, the feldspars are calculated from the amounts of K_2O, Na_2O, and CaO present in the analysis. Orthoclase is considered pure K_2O, Al_2O_3, $6SiO_2$, and all the soda is calculated as part of the plagioclase. As a matter of fact, a considerable amount of the soda may occur in the orthoclase or microcline as lamellar intergrowth, either visible or invisible. Where all is calculated in the plagioclase, the resulting mineral is too near the soda end. Potash in muscovite is disregarded, and the only lime or alumina used for the dark minerals is that which occurs in excess of the requirement of the theoretical feldspars.

So far as the first part of the formula is concerned, no objection can be made to it, since it is confessedly chemical. It has the advantage of simplicity over the C.I.P.W. system, and can be shown in a diagram. Whether it is better than Osann's system is a question. Certainly Osann's latest modification (*Der chemische Faktor in einer natürlichen Klassifikation der Eruptivgesteine,* Heidelberg, 1919. Review to follow in this *Journal*) offers a rapid means for finding rocks of similar composition. Since only Part I of Hommel's book is printed, however, it is possible that similar groups of rocks may appear later.

Hommel's system can best be illustrated by an example. The kern granite of the Brocken in molecules, reduced to 100, gives SiO_2 80.2, TiO_2 —, Al_2O_3 8.6, Fe_2O_3 0.5, FeO 1.5, MgO 0.4, CaO 1.4, Na_2O 3.3, K_2O 4.1. Hommel's formula for this rock is:

$$80.2\overset{3.3}{\underset{1.2}{\Sigma}}\ 4.1\ \underset{2}{\dot{\mathrm{F}}}\ \ddot{\mathrm{e}}\ \ddot{\mathrm{m}}\mathrm{c}\ 2.6=+31\ \mathrm{P}\ \left[\dot{\mathrm{O}}_{33}\dot{\mathrm{O}}\mathrm{l}^{\circ}_{31}\right]\dot{\beta}\ 5.$$

The first part is the molecular formula and is obtained as follows: The figures 80.2 represent the amount of the silica molecules (plus TiO_2 and P_2O_5) as computed above. The large figures immediately after the sign Σ represent the K_2O molecules; the Na_2O mol. and the CaO mol. in feldspar being represented by the figures above and below the sign. The CaO figures necessarily cannot be greater than the amount of Al_2O_3 remaining after enough has been used to satisfy the soda and potash. Excess CaO is added to the mafic minerals as *c*. The mafic constituents are represented by *e* for Fe_2O_3, *f* for FeO+MnO, *m* for

MgO, and *c* for the remaining CaO. If all of the CaO was used for feldspar, the excess of Al_2O_3 is represented by *t* among the mafic constituents. If there is insufficient Al_2O_3 to satisfy the alkalies, the remaining Na_2O is indicated by *n* and it also is placed among the ferromagnesian constituents. In the above example, $K_2O+Na_2O=4.1+3.3=7.4$, corresponding to 7.4 Al_2O_3 leaving 1.2 Al_2O_3 to unite with CaO for the anorthite radical. The remaining 0.2 CaO is represented by *c* among the mafic constituents. The ferromagnesian constituents are given in the order of decreasing abundance, and their sum is represented by the figure following (here 2.6). The relative abundance is indicated in the symbol, thus

fm indicates an FeO/MgO ratio below 5 FeO/4 MgO.

$\dot{f}=1\frac{1}{2}$ f, therefore $\dot{f}$m shows a ratio between 4FeO:3MgO and 3FeO: 2MgO.

$\ddot{f}=2$ f, or $\ddot{f}$m indicates the ratio of 2/1.

F=3f, and Fm=3 FeO to 1 MgO.

$\dot{F}=4$f, and $\dot{F}$m=4/1.

$\ddot{F}=5$f, and $\ddot{F}$m=5/1.

$F_2=6$f,

$\ddot{F}_2=8$f,

$\dot{F}_3=10$f,

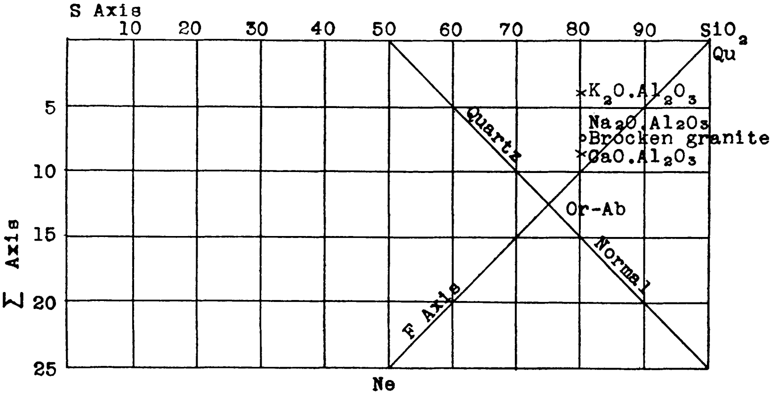
$F_4=12$f, etc., etc.

Since the remaining constituents in the order of decreasing abundance in the example given are FeO=1.5, Fe_2O_3=c.5, MgO=0.4, and CaO=0.2 (the ratios being therefore as 7 : 2.5 : 2 : 1 approximately), they are represented by $\dot{F}_2 : \ddot{e} : \ddot{m} : c$. (These symbols are complicated. Why not use the ratio directly as subscripts; thus here $F_{1.5} . e_{0.5} . m_{0.4} . c_{0.2}$, or even the simplified similar ratios $F_7 . e_{2.5} . m_2 . c$).

The rock may be plotted on rectangular co-ordinates as shown by the figure. The horizontal line (*S* axis) represents the silica content. The vertical line through 50 per cent is the Σ axis and is the measure of the feldspar content. It is drawn at double the scale of the *S* axis because for each molecule of alkali or lime, a molecule of Al_2O_3 is also automatically included. Further, there are two diagonal lines at 45° through the 50 per cent and 100 per cent points on the *S* line; the former is called the quartz normal, the latter the *F* axis.

The Brocken granite is thus plotted by measuring from the 80.2 point on the *S* axis downward 4.1 for K_2O. This *K* point is indicated by an *x*. A further distance of 3.3 for Na_2O is laid off on the same line and the point is marked by a circle. This is called the Locus of the rock (*Ort des Gesteins*). Finally 1.2 is plotted on the extension of the line for CaO, and this is also marked by an *x*. This is the Σ point. The horizontal distance of the Σ point from the *F* axis (in units as measured on *S*) gives the amount of the ferromagnesian constituents. The amount of free (theoretical) quartz is given by the horizontal distance of the Locus of the rock from the "Quartz normal." (As measured on the *S* scale, the reading is to be multiplied by 2.) In the case of the Brocken granite this distance is 15.4, therefore the theoretical amount of free quartz is 30.8.

Since the quartz normal and the *F* axis are both at 45°, the readings may be made along the downward extension of the line passing through the locus of the rock, instead of along the horizontal.



The second part of the formula, the "Konstitutionsformel," represents theoretical minerals. The method for computing the free quartz follows from the diagram. Twice the sum of the alkalies is subtracted from the silica value less fifty (the diagonal line starting at the 50 point), and the result is multiplied by two.

Free quartz $= 2[(SiO_2 - 50) - 2(K_2O + Na_2O)]$, where SiO_2, K_2O, etc., are molecular values. The Brocken granite therefore gives $2[(80.2 - 50) - 2(4.1 + 3.3)] = +30.8$ or approximately +31. The plus sign gives the position of the rock above the quartz normal in the diagram, and shows free quartz. Below the line is shown by a minus sign. This indicates nephelite, olivine, etc. The letter *P* (plutonic) indicates the texture. *O* stands for orthoclase. Its value is obtained by multiplying the K_2O mol. by 8, since the formula is $K_2O.Al_2O_3.6SiO_2$. ($K_2O = 4.1$, $O = 8 \times 4.1 = 32.8$ or ca.33). The plagioclase indicated by the molecular formula is 3.3 Na_2O, 1.2 CaO, or basic oligoclase, Ab_6An_1. The molecular value of the albite is eight times the Na_2O, but the anorthite, with the formula $CaO.Al_2O_3.2SiO_2$ is only four times the CaO. ($3.3 \times 8 + 1.2 \times 4 = 31.2$). The symbol for basic oligoclase is Ol^c. Beta indicates biotite, and 5 per cent represents the remainder left for this mineral. It amounts, of course, from the formula $RO.SiO_2$ to twice the *F* value.

With insufficient Al_3O_3, the symbol Δ is used in the formula instead of Σ, and the aegirite molecule takes the place of the anorthite. Thus Δ 4 means

$4(K_2O.Al_2O_3)$. $6(Na_2O.Al_2O_3)$. $2(Na_2O.\ Fe_2O_3)$. These rocks may contain free quartz (or nephelite). Where there is quartz it is to be noted that only four molecules of SiO_2 are required to one of Na_2O, consequently there will be more quartz than in the case where all the soda goes into feldspar. The formula for the quartz, in this case, consequently, reads $2[(SiO_2 \text{mol.} - 50) - \{2(K_2O \text{ mol.} + Na_2O \text{ mol.}) + \text{aeg. mol}\}]$.

With insufficient silica, so that a negative result is obtained by the quartz formula, it is evident that olivine or nephelite (or leucite) is present. The formula here is divided instead of multiplied by 2, and we have nephelite $= \frac{SiO_2 - 50 - [2(K_2O + Na_2O) + \text{aeg. mol.}]}{2}$ (the alkali molecules are those in feldspar and feldspathoid only).

Examples of the nephelite rocks and rocks with insufficient alumina would make this abstract too long.

The third section of the book consists of a natural classification of rocks on genetic principles. A detailed description is impossible here and the reader is referred to the original work which is full of suggestions. Briefly, rocks are divided into five groups: (1) the orthogene class of rocks includes those formed by slow cooling in the interior of the earth; (2) the paragene class originated in a relatively rapid cooling of the magma during the period of crystallization of olivine, consequently that mineral could not settle out but is represented by its recrystallizations as diopside, etc.; (3) the hypogene class includes extrusive rocks formed under conditions of rapid cooling, relief from pressure, and movement; (4) peratogene rocks are those altered by metamorphism and include the crystalline schists; (5) diagene rocks include the sediments. The first four groups are subdivided into ten zones each, each zone representing a distinct temperature-interval through which the magma passed on cooling, and marked by the separation of typical and chemically well-defined minerals. There are thus the zones of (1) chromite, (2) olivine, (3) enstatite, (4) diopside, (5a) labradorite, (5b) nephelite, (6) labradorite-andesine, (7) andesine, (8a) andesine-oligoclase, (8b) oligoclase, (9) orthoclase, (10) quartz.

The book is one which will repay very careful study in every part. While one might wish that the "Konstitutionsformel" represented actual rather than theoretical minerals, one can easily understand how the former might make difficulties in certain cases. Undoubtedly this book is one of the most important works on petrography that has appeared in recent years.

IDDINGS, J. P., and MORLEY, E. W. "A Contribution to the Petrography of the South Sea Islands," *Proc. Nat. Acad. Sci.*, IV (1918), 110–17.

This is a preliminary statement of the geological structure and character of seven islands of the South Seas, including Tahiti, Moorea, and the Society Group. Thirty new chemical analyses are here published for the first time.

The rocks of Tahiti are almost wholly olivine basalts, some with nephelite or analcite. Trachytic and phonolitic lavas occur on five of the seven islands. A nephelite-latite, consisting of alkalic feldspar and andesine with some nephelite and sodalite and abundant hornblende, much titanite, and few augites and micas is given the new name of *tautirite*, from the valley, Tautira, Taiarapu, in which it occurs. The mode is not given but the norm contains Or 31.1, Ab 28.3, An 13.3, and Ne 10.8.

JEHU, T. J., and CAMPBELL, ROBERT. "The Highland Border Rocks of the Aberfoyle District," *Trans. Roy. Soc. Edinburgh*, LII (1917), 175–212, figs. 10, pls. 6.

A series of grits, shales, limestones, cherty shales, graphitic shales, and various igneous rocks, in places highly altered, extending from Stonehaven to Arran, is grouped under the term "The Highland Border Rocks." They are here arranged in two divisions. The sediments of the Lower Series are either Upper Cambrian or transitional between Cambrian and Ordovician, and are thought to have been deposited in clear water near the verge of sedimentation. The lavas indicate submarine eruptions. The Upper Series, which belong higher in the Ordovician, include limestones, hornblende- and chlorite-schists, and igneous rocks.

JOHANNSEN, ALBERT. *Essentials for the Microscopical Determination of Rock-forming Minerals and Rocks in Thin Sections.* Chicago, 1922. Quarto, pp. vi + 54, figs. 24, pls. 6, and a folding table.

This laboratory manual contains practically all of the data originally published in the writer's *Determination of Rock-forming Minerals*, and in addition gives modes of occurrence and many more points of separation between similar minerals. Only a few very rare species, such as johnstrupite, mosandrite, laavenite, etc., have been omitted, but by uniting the tables which contained minerals having birefringences greater or less than quartz, and refractive indices greater or less than Canada balsam, much repetition has been avoided, and the number of pages has been materially reduced. Orthorhombic minerals have been united with the other biaxial minerals, since sections which cut all of the crystallographic axes in this system show inclined extinction, but the extinction angles are given in the descriptions. The separation lines between the various plagioclase feldspars have been changed from those given in the former book to 5, 27½, 50, 72½, and 95 per cent anorthite. Albite and anorthite have been limited to a variation of only 5 per cent since these names are also applied to the pure end members, and compound names, such as oligoclase-albite, labradorite-bytownite, etc., have been omitted. The section on the determination of the feldspars has been but little reduced, but that on optical methods has been condensed as much as possible, since this data is given elsewhere. The alphabetical list of minerals has been much extended, and is now placed at the back of the book in such a position that it may be consulted without turning pages. Finally, a short section on the classification of igneous rocks according to the author's system has been added. As given here, this classification is essentially the same as that published in the *Journal of Geology* several years ago, except that the whole of the monzonitic series, with the exception of monzonite and quartz-monzonite, has been omitted.

KAISER, ERICH. "Der Eläolithsyenitlakkolith der Serra de Monchique im südlichen Portugal," *Neues Jahrb.*, B. B., XXXIX (1914), 225–67, pls. 2, profiles 2, map 1, figs. 6.

Discusses the structure of the Serra de Monchique in southern Portugal, with special reference to the nephelite-syenite central mass. He considers this a laccolith that was intruded during the period of folding. The main foyaitic mass with border pulaskites, and various dike-rocks are briefly described.

KAISER, ERICH. "Über ein Demonstrationsmikroskop für den mineralogischen und petrographischen Unterricht," *Zeitschr. f. Kryst.*, LIII (1914), 397–403.

Describes a microscope for demonstration purposes. It has a large, rotatable stage with ten openings, so that that number of thin sections can be placed on it at one time, and the specimens observed one after the other. A glass plate prevents the disturbance of the sections by students. Since the preparations cannot be turned there is provided a means for rotating the tube of the microscope.

KAISER, ERICH. "Studien während des Krieges in Südwestafrika," *Zeitschr. d. deutsch. geol. Gesell.*, LXXII (1920), 50–76.

The three studies included in these papers are: (1) Assimilationsercsheinungen an den Elaeolithsyeniten des Granitberg in südlichen Namib," (2) "Zur Kenntnis der Hohlformen, Eindeckungen, Ausfüllungen und Aufschüttungen der Trockengebiete," and (3) "Kalkkrusten." In the first paper the nephelite-syenite stock of Granitberg, in southern Namib, is described. Besides the normal rock there are certain other types which cannot be explained by normal differentiation. The contact of the main mass is irregular and blurred, owing to the penetration of the country rock by numerous veins and apophyses of the igneous rock, thus giving the impression of an irregular breccia penetrated by the nephelite-syenite. But it is not a breccia in the ordinary sense since the fracturing was caused by the intrusion itself. Both intrusive and intruded rock are altered, the character of the resultant depending upon the nature of the country rock. Against sandstone and arkoses there is a decrease in the feldspathoids and a transition to syenite and even to quartz-bearing and nephelite-free alkali granites. Where the igneous rock is in contact with the dolomitic Cambrian rocks there is an increase in the amount of nephelite and the grain is coarse, in some cases giving nephelite-syenite-pegmatite phases with nephelites several centimeters in size. Such changes in the character of the rock cannot be explained by differentiation alone. Kaiser thinks that assimilation of the country rock is clearly indicated, although he supposes that there was also subsequent differentiation. He warns, however, against using such local occurrences either for or against the assimilation theory of magmas in general. The mechanics of the intrusion, he thinks, agree with Daly's theory of magmatic stoping. He believes the magma reached its present position not by intrusion between strata, but by forming a place for itself.

KAISER, ERICH. "Bericht über geologische Studien während des Krieges in Südwestafrika," *Abhandl. d. Giessener Hochschulgesell.*, II (1920). Pp. 57, pls. 6, figs. 4

A general geological description of Namib, an interesting petrographic description of which is given in greater detail in the preceding paper. The scope of the work is indicated in the chapter headings, some of which are crystalline schists, Cambrian, eruptive rocks, Tertiary, alteration of the Tertiary land surface, underground water, mineral occurrences, etc.

KATŌ, TAKEO. "Microscopic Secondary Sulphide Enrichment in the 'Kuromono' Ore from the Kosaka Mine, in the Province of Rikuchü, Japan, *Jour. Geol. Soc. Tokyo*, XXV (1918), 1–7, pls. 1.

KATŌ, TAKEO. "A Contribution to the Knowledge of the Mesozoic Igneous Rocks Developed Around the Tsushima Basin, Japan, *Jour. Geol. Soc. Tokyo,* XXVII (1920), 1–22, 23–38, pls. 4, figs. 2.

A porphyrite complex with associated tuff beds, late Jurassic in age, was invaded by a series of igneous rocks in the following order: (1) effusive quartz-porphyry; (2) intrusive quartz-masanite, masano-tonalite, etc., with melanocratic marginal facies; (3) tsingtauites and masano-tsingtauites; (4) dikes of masano-hornblendite; (5) aplitic and pegmatitic rocks. The rocks of (1) and (2) were probably derived from the same magma basin; (2), (3), (4), and (5) are clearly related. Sporadic corroded quartz crystals in some portions of the porphyrite as well as those in many lamprophyres are thought to have sunk from the overlying acid magma layers, in which they were beginning to form, into the basic lower layers from which the basic rocks were derived.

KATŌ, TAKEO. "A Contribution to the Knowledge of the Cassiterite Veins of Pneumato-Hydatogenetic or Hydrothermal Origin, *Jour. Col. Sci. Imp. Univ. Tokyo,* XLIII (1920), Art. 5. Pp. 60, map 1, pls. 6, figs. 11.

Largely economic, although a considerable number of pages are devoted to igneous rocks. Among these are diorite, gabbroid-diorite, diorite-mylonite, and a rock to which the new name "akenobeite" is given. Dike-rocks are hornblende-hypersthene-andesite, garnetiferous-felsite-porphyry, felsite, porphyrites, and diabase, and there is extrusive rhyolite. The rocks are described in some detail but neither chemical nor modal analyses are given. The akenobeite is a quartz-monzonite-pegmatite or -aplite, according to Kato. It consists of tabular crystals of feldspar in haphazard orientation with the interstices filled with an aggregate of quartz. The feldspar is orthoclase and oligoclase, the latter always in excess. How much in excess is not stated, so it is a question whether the rock might not be called a granodiorite-aplite. Biotite is very subordinate and occurs in minute flakes in the feldspars or attached to its borders. In the system of the reviewer it belongs to Class 1, Order 2, Family 7 (new form), and probably in 7″. The amount of quartz is not stated, but from the two photographs given it appears to amount to 15 or 20 per cent.

KLEMM, G. "Die Granitporphyre und Alsbachite des Odenwaldes," *Notizbl. d. Vereins f. Erdk.,* etc., z. Darmstadt, IV Folge, Hf. 35, 1914. Pp. 10–50, pls. 2, fig. 1.

In the crystalline schists of the Odenwald there are various dikes of anorthoclase-granite-porphyry and of alsbachite. Of the former rock there are twelve chemical analyses, eight of them apparently new, and of the latter, three, of which two are new. Five new analyses of dike granites are also given. All the analyses are re-computed into Osann's system.

KLEMM, G. "Bemerkungen über die im Gabbro des Frankensteins gangartig aufsetzenden Gesteine und über seine Einschlüsse von Korundfels," *Notizbl. d. Vereins f. Erdk.,* etc., z. Darmstadt, IV Folge, Hf. 35, 1914, 5–9.

Describes certain corundum-bearing rocks occurring in the Frankenstein gabbro. The author disagrees with Kalkowsky, who regards them as differentiation products of the gabbro magma, but considers them metamorphosed inclusions of sedimentary rocks which were resorbed by the gabbro and later recrystallized.

Klemm, G. "Über die angebliche Umwandlung von Andalusit in Disthen in den Hornfelsen des Schürrkopfes bei Gaggenau in Baden," *Zeitschr. d. Deutsch. Geol. Gesell.*, LXVIII (1916), 86-92.

Eisele regarded the disthene in the hornfels from Schürrkopf in Baden as due to alteration of andalusite by orogenic pressures which were post-contact-metamorphism; Klemm regards the two minerals as contemporaneous products.

Klemm, G. "Zur Errinerung an Richard Lepsius," *Notizbl. d. Vereins f. Erdk.*, etc., z. Darmstadt, V Folge Hf. 1, 1915, 5-22. With portrait and bibliography.

Klemm, G. "Die korundführenden Hornfelse und die Schmirgelgesteine von Laudenau und Klein-Gumpen bei Reichelsheim im Odenwald und ihre Nebengesteine," *Notizbl. d. Vereins f. Erdk.*, etc., z. Darmstadt, V Folge, Hf. 1, 1915, 23-41, pl. 1.

This is a more detailed description of the corundum-bearing rocks of the Odenwald, mentioned in the third preceding abstract. Ten new analyses are given.

Klemm, G. "Über den 'Variolit von Asbach,'" *Notizbl. d. Vereins f. Erdk.*, etc., z. Darmstadt, V Folge, Hf. 2, 1916 (1917), pl. 1.

The "variolite" from Asbach, called diabase by Chelius, is here determined as malchite. The varioles, representing fillings of vesicles, vary in size from hazel-nuts to walnuts, occasionally to the size of eggs. They consist of quartz feldspar, iron ore, and epidote.

Klemm, G. *Blatt Neunkirchen.* Erläuteru. z. Geol. Karte Hessen. 2d ed. Darmstadt, 1918. Pp. 81, pl. 1.

In this general geological report on the quadrangle lying between lat. 49°48′ and 49°32′, in Hessen, there are short descriptions of many igneous rocks, and analyses of 4 hornfelses, 2 amphibolites, 9 gabbros, 3 hypersthene-gabbros, 3 serpentines, 4 diorites, 14 granites, 5 granite-porphyries, 2 granophyres, 9 malchites, and 6 odinites.

KLEMM, G. "Über die Enstehung der 'Felsenmeere' des Felsberges und anderer Orte im Odenwalde," *Notizbl. d. Vereins f. Erdk.*, etc., z. Darmstadt, V Folge, Hf. 3, 1917 (1918), 3–11, pls. 2.

Considers these particular rock-streams as due to removal of interstitial weathered material. The blocks lie practically in the positions where they were originally formed.

KLEMM, G. "Der Granatfels von Gadernheim im Odenwalde und sine Nebengesteine," *Notizbl. d. Vereins f. Erdk.*, etc., z. Darmstadt, V Folge, Hf. 4, 1919, 3–32.

The flaser granite of Gadernheim shows an original contact at the south and east against metamorphosed sediments. This metamorphism was produced by gabbro which altered the sediments to garnetfels, cordierite-hornfels, biotite-hornfels, amphibolite, graphite-schist, and graphite-quartzite. The gabbro itself was altered by endogene contact action to hornblende-gabbro with a dioritic selvage.

KOLDERUP, CARL FRED. "Egersund," *Norges Geol. Undersök*, No. 71, 1914. Pp. 60, pls. 4, map 1.

A geologic report on a quadrangle in the southwestern part of Norway, about 60 km. SSE. of Stavanger. The principal part of the area is composed of labradoritites and pyroxene-poor norites. The composition of one of the latter is given (p. 18) as labradorite 92 per cent, pyroxene 7 per cent. and ilmenite 1 per cent. There is a smaller area of mangerites and norite-mangerites. Among the dike-rocks are mangerite, birkremite, quartz, ilmenite, granite-pegmatite, and diabase.

KOLDERUP, CARL FRED. "Fjeldbygningen i strøket mellem sørfjordem og Sammangerfjorden i Bergensfeltet," *Bergens Museums Aarbok*, 1914–15, No. 8. Pp. 257, figs. 91, colored pls. 2, maps 3.

The district of the Bergen arches is characterized by a peculiar arrangement of the various formations in curves. The rocks are dynamo-metamorphosed and are in part sedimentary and in part igneous. Phyllites are the most common sediments, and consist of quartz and muscovite with various accessories. In the phyllite zone occur serpentines, soapstones, green-schists, saussurite-diabases, saussurite-gabbros, labradoritite, norite, mangerite, and birkremite. The serpentines are considered metamorphosed igneous rocks, probably peridotites or pikrites. The green-schists were probably originally basic volcanic rocks and tuffs. In the western part of the area are Middle Silurian limestones, metamorphosed to marble. Younger than the marble for it contains fragments of this rock, is the polymict conglomerate. It is probably a volcanic conglomerate whose cement originally was a tuff. The "gray granite" of Reuss is considered a pressed granite.

The structure of the area indicates that the metamorphism must have taken place in the upper part of the earth's crust where one-sided pressure, low temperature, and a considerable saturation with water were factors. The rocks of the inner arch are more strongly compressed than those of the outer, but the materials are of approximately the same kind.

KOTŌ, BUNDJIRO. "The Great Eruption of Sakura-jima in 1914," *Jour. Col. Sci., Imp. Univ. Tokyo,* XXXVIII (1916). Pp. 237, pls. 23, map 1, figs. 46.

Sixty-eight pages of this elaborate report are devoted to petrography. The descriptions are accompanied by 61 photomicrographs on 8 photogravure plates, which are beautifully clear and of considerable help. The author states that "the characterization of the rocks is merely of preliminary qualitative nature." It is to be hoped that quantitative determinations may be published later. The older lavas of the volcano are hypersthene-andesites, and are *dull* black or light brown porous and light in weight; the later lavas are *pitch* black, slaggy, and heavy, and are hypersthene-bearing pyroxene-andesites with sporadic olivine. The lavas of 1914 are also olivine-bearing hypersthene-andesites and are like those of 1779. Among the inclusions in the lava are fragments of earlier segregations, among them a lava composed principally of anorthite (printed anorthosite by mistake on p. 191) with interstitial orthoclase (?). This rock is called microtinite but deserves a new name, since microtinite as described by Lacroix was neither a pure nor nearly pure anorthite rock. No quantitative data as to the relative amounts of the two feldspars are given. The name *ceramicite* is given to porcelain-like ejectamenta which contain cordierite as the characteristic component. The other constituents are basic plagioclase and colorless glass, with subordinate hypersthene. Quartz is said to be totally wanting. With 23 beautiful photogravure plates, one may overlook the muddy half-tones which disfigure the text.

KŌZU, S. (1) "The Dispersion Phenomena and the Influence of Temperature on the Optic Axial Angle of Sanidine from the Eifel;" (2) "The Dispersion Phenomena of Some Monoclinic Feldspars," *Mineralog. Mag.,* XVII (1916), 237-52, 253-73.

Many valuable determinations on the optic axial angles and dispersion in feldspars, which would be more valuable if chemical analyses of the materials used were given.

LACROIX, A. "Les roches basiques non volcaniques de Madagascar," *Comptes Rendus*, CLIX (1914), 417–21.

Anabohitsite is a new name given to a "pyroxenite" with olivine, hypersthene, hornblende, and 30 per cent ilmenite and magnetite. It forms the periphery of the gabbro massif in Anabohitsy. The amount of olivine is not stated. Why not a peridotite? An analysis is given.

LACROIX, A. "Sur un type nouveau de roche granitique alcaline, renfermant une eucolite," *Comptes Rendus*, CLX (1915), 253–57.

A rock composed of much quartz, alcalic feldspar (microperthitic soda-orthoclase or anorthoclase with albite, in other cases albite alone), aegirite, riebeckite, and eucolite, occurring either fine-, medium-, or coarse-grained, is given the name *fasibitikite*. It is compared with rockallite. A chemical but no modal analysis is given.

LACROIX, A. "Sur quelques roches volcaniques mélanocrates des Possessions françaises de l'océan Indien et du Pacifique," *Comptes Rendus*, CLXIII (1916), 177–83.

Describes and gives analyses of two rocks which "are more calcic than feldspathic picrites, generally a little more ferruginous, and a little richer in silica. They are separated from the picrites in that their pyroxene is in excess over olivine. Further the quantity of light-colored constituents is often a little greater." No mineral percentages are given, consequently it is difficult to place it. Possibly a labradorite (?) bearing picrite. To it is given the new name *ankaramite*.

LACROIX, A. "La constitution des roches volcaniques de l'Extreme Nord de Madagascar et de Nosy bé; les ankaratrites de Madagascar en général," *Comptes Rendus*, CLXIII (1916), 253–58.

Melanocratic nephelite-basalts with considerable feldspar and phenocrysts of olivine, titaniferous augite in the form of microlites, ilmenite, often perofskite, and biotite are given the new name *ankaratrite*. The nephelite never forms more than 10 to 15 per cent of the rock and is in many cases accompanied by melilite. With simply a description for a definition, its relationship to other rocks is indeterminable.

A granular rock formed of augite and nephelite with a little olivine, biotite, apatite, and some orthoclase is called *fasinite*. Rosenbusch's *definition* of bekinkinite would cover this rock, but Lacroix says the *rock* from Bekinkiny generally contains plagioclase, is always richer in hornblende, and has part of the nephelite changed to analcite. The unfortunate usage of giving locality names to new rock types is ever a cause for confusion. Should the original definition be considered the standard, or must a rock possess every accessory of the original rock to be of the same type, that is, should the words of the definition or the rock from a certain locality be the standard? If the latter, then practically every outcrop should have a new name, for slight variations will always be found.

LACROIX, A. "Les syénites à riebeckite d'Alter Pedroso (Portugal), leurs formes mésocrates (lusitanites) et leur transformation en leptynites et en gneiss," *Comptes Rendus*, CLXIII (1916), 279–84.

Under *lusitanite*, after the name of the country where found, there is described a mesocratic riebeckite-aegirite-syenite. Where new names are based upon variations in the mineral percentages, modal percentages should be given.

LACROIX, A. "Les laves à haüyne d'Auvergne et leurs enclaves homoeogènes," *Comptes Rendus*, CLXIV (1917), 581–87.

Ordanchite is applied to certain hauynite-tephrites from la Banne d'Ordanche. Phenocrysts of plagioclase ("oscillent entre le labrador et l'andésine"), blue hauynite, more or less corroded hornblende, and augite are visible to the unaided eye. Microscopically there are seen in addition titaniferous magnetite, titanite, apatite, and rarely olivine. *Tahitite*, after its occurrence on Tahiti, is a lava resembling ordanchite but more alcalic. Lacroix considers it a microlitic form of nephelite-monzonite. It contains phenocrysts of hauynite in a vitreous groundmass of microlites of augite, titaniferous magnetite, hauynite, and perhaps a little orthoclase and leucite. *Mareugite* is a name given to a medium-grained rock from Mareuges, Auvergne, which contains 60 per cent light minerals (bytownite and hauynite). The dark minerals present are not mentioned, but in an associated rock, called type two, they are hornblende, augite, titaniferous magnetite, and a little blue hauynite, and therefore they apparently also occur in the mareugite.

LACROIX, A. "Les laves leucitiques de la Somma," *Comptes Rendus*, CLXV (1917), 481–87.

Vesuvites are the leucite-tephrites from Vesuvius. Four apparently new analyses are given. Nine analyses of "ottajanites" are also given. They contain more plagioclase and less leucite than the vesuvianites, but since no proportions are given the dividing lines cannot be stated. Terms such as more, less, little, and much are of no value for comparison.

LACROIX, A. "Les roches grenues d'un magma leucitique étudiées à l'aide des blocs holocristallins de la Somma," *Comptes Rendus*, CLXV (1917), 205–11.

Ottajanites are leucite-tephrites having the chemical but not the mineralogical composition of sommaites. They are microlitic and contain leucite and plagioclase. *Vesuvites* are the leucite-tephrites of Vesuvius. These are described in more detail in a later publication (see next abstract). *Puglianites* are coarse-grained rocks composed of automorphic augite in a groundmass of leucite and anorthite. Certain varieties contain a little biotite, hornblende, and orthoclase. *Sebastianites* are like the puglianites chemically but are different mineralogically. They are composed of more or less automorphic anorthite, with a little augite, apatite, and biotite. Leucite is absent, all the potash being in the biotite. Chemical analyses but no modal percentages are given.

LACROIX, A. "Les formes grenues du magma leucitique du volcan laziale," *Comptes Rendus*, CLXV (1917), 1029–34.

Braccianite is applied to certain leucitites from the Lake of Bracciano but why given a new name is not clear, except to distinguish them from the Capo di Bove leucitites.

LACROIX, A. "Dacites et dacitoïdes, à propos des laves de la Martinique," *Comptes Rendus*, CLXVIII (1919), 297–302.

According to Lacroix, petrographers classify as dacite only those quartz-bearing andesites which have phenocrysts of quartz; those having quartz in the groundmasses or hidden in glassy groundmasses, and therefore only shown chemically, he says are called andesites. The latter rocks he would call dacitoides. He would extend the term to cover, not only the extrusive equivalents of the quartz-diorites, but also quartz-gabbros, in that he would have oligoclase-, andesine-, and labradorite-dacitoides, to the further confusion of present nomenclature. (H. S. Washington, *Amer. Jour. Sci.*, L [1920], 456, objects to these terms and uses Rosenbusch's term hyalodacite.)

LACROIX, A. "La constitution minéralogique et chimique des laves des volcans du Tibesti," *Comptes Rendus*, CLXIX (1919), 169–75.

In this paper *basanitoïdes* is proposed for basanites in which the nephelite is not crystallized but remains "potential in the glass." Chemically they are basanites.

LAITAKARI, AARNE. "Einige Albitepidotgesteine von Südfinnland," *Bull. Comm. Geol. Finlande*, No. 51, 1918. Pp. 13, figs. 5.

The term *helsinkite* is proposed for a haphazard-textured dike-rock, consisting of albite and epidote, and in some cases quartz (quartz-helsinkite). There is, in some cases, a little microcline, biotite, apatite, and iron ore. The amount of epidote varies from 15 to 35 per cent. In the specimen analyzed there is about 31 per cent epidote and 67 per cent feldspar, of which microcline forms less than 5 per cent (see review of Mäkinen), consequently it belongs, in the reviewer's system, to 2112 (new form). Both albite and epidote are thought to be primary magmatic minerals, the CaO having formed epidote rather than anorthite in plagioclase on account of greater water content and lower temperature of crystallization than the surrounding granite.

LAITAKARI, AARNE. "Über die Petrographie und Mineralogie der Kalksteinlagerstätten von Parainen (Pargas)," *Bull. Comm. Geol. Finlande*, No. 54, 1921. Pp. 113, figs. 40, pls. 3.

The island of Ålö, in South Finland, consists principally of migmatite, a mixture of granite and gneiss. Within this rock are long, narrow lenses of limestone, calcareous gneiss, and amphibolite, which represent remnants of strata which were infolded in the igneous rock. Cutting all these rocks there are granitic and basic dikes. A short introduction of 5 pages, descriptions of rocks 28 pages, descriptions of minerals 57 pages, contact action 7 pages, mineral paragenesis and metamorphism of the limestone 5 pages, and a bibliography of 7 pages comprise the report.

LARSEN, ESPER S. "The Microscopic Determination of the Nonopaque Minerals, *Bull. 679, U.S. Geol. Survey*, Washington, 1921. Pp. 294.

In this very valuable bulletin, Mr. Larsen gives data for determining by their refractive indices all of the transparent minerals recognized by Dana in his *System of Mineralogy* as well as a considerable number not given by him. Thus, if the optical properties are known, there is afforded a rapid means for determining the minerals by immersion in liquid media of known indices. Furthermore, about 125 pages give the results of new measurements of optical constants of about 500 species for which data was not previously available. The bulletin is invaluable and should be in the hands of every petrographer.

LARSEN, ESPER S., and HUNTER, J. F. "Melilite and Other Minerals from Gunnison County, Colorado," *Jour. Washington Acad. Sci.*, IV (1914), 473–79.

While this paper is principally mineralogic, here is first proposed the new name *uncompahgrite*, from the Uncompahgre quadrangle, Colorado, where the rock was found. It is a coarse-grained rock made up of about two-thirds or more melilite, with considerable pyroxene, magnetite, perofskite, and apatite, while in places biotite, calcite, and other minerals occur. In texture it is commonly coarse, but varies. Cleavage pieces of melilite a foot across and mottled by inclusions of other constituents are not uncommon. The finest grained rock is hypautomorphic-granular with crystals averaging 1 mm. across. In the new system of the reviewer, the rock belongs to 2125.

LARSEN, ESPER S., and MANSFIELD, GEORGE R. "Nepheline Basalt in the Fort Hall Indian Reservation, Idaho," *Jour. Washington Acad. Sci.*, V (1915), 463–68.

The mode of this nephelite-basalt, as given by Mr. Larsen, is nephelite 20, diopside 39, forsterite 26, biotite 8, magnetite 3, ilmenite 1, and apatite 1 per cent. In the reviewer's system it belongs in 3125 (new form).

LEHMANN, E. "Die Ermittlung der Brechungsexponenten der Mineralien im Dünnschliff durch Vergleich mit Canadabalsam und Kollolith," *Centralbl. f. Min.*, etc., (1921), 102–12.

The refractive index of Canada balsam in certain slides was found to be lower than the recently accepted values, being less than 1.5243. A series of experiments with Kollolith showed that the refractive index depended upon the original solvent and upon the temperature of heating. With hard kollolith and a temperature of 150° to 156°, the resulting mount was found to have practically a constant value of 1.5335, but with kollolith dissolved in xylol exposed to air, or under cover-glasses, the values varied from 1.519 to 1.5343, though the first averaged values between 1.5231 to 1.5343 and the latter 1.5257 to 1.5298, depending upon the time of exposure to the air, the higher values being obtained after about six weeks.

LYNES, HUBERT, AND SMITH, W. CAMPBELL. "Preliminary Note on the Rocks of Darfur." *Geol. Mag.*, LVIII (1921), 206–15.

The author describes rocks from the volcano of Dereiba and from various other points between there and El Obeid, Africa. None from this area has previously been described. Troctolite, granite, graphic granite, sandstones, gneisses, and quartz-monzonite occur on the road. The rocks of the volcano are quartz-bearing soda-trachyte, soda-trachyte, quartz-bearing riebeckite-trachyte, andesine-bearing kenyte, and mugearite.

MÄKINEN, EERO. "Översikt av de Prekambriska Bildningarna i Mellersta Österbotten i Finland," *Bull. Comm. Geol. Finlande*, No. 47, 1916. Pp. 152, map 1, figs. 25.

The pre-Bothnian rocks of the district described are represented by two small areas of ortho-gneisses. The Bothnian complex consists of plagioclase-gneiss, mica-schist, conglomerate-gneiss, quartzite, and limestone, with some leptites. All but the latter are of sedimentary origin. Even the plagioclase-gneiss, which in chemical composition approaches certain igneous rocks, is sedimentary. The rocks have been formed, to a considerable extent, of unweathered volcanic material (volcanic ashes, as well as mechanically disintegrated materials from tuffs and lava beds) partly assorted and deposited in water. Associated with these rocks are certain intrusives and extrusives, mainly plagioclase-porphyrites, uralite-porphyrites, and amphibolites. The post-Bothnian rocks form a comagmatic series, chiefly abyssal but in part hypabyssal in character. The rocks are granite, syenite, granodiorite, quartz-diorite, diorite, gabbro, diabase, hornblendite, and peridotite. In the southwestern part of the area there were apparently two periods of intrusion from a magma differentiated *in situ*. In the parish of Haapavesi to Kivijärvi, there is no evidence of two periods of intrusion but the rocks, from granite to granodiorite and gabbro, grade into each other. The northern and eastern part of the area is an area of migmatites. Here the magma has been differentiated to a certain extent, but the different rocks have not been separated to form large homogeneous masses. The older rocks have undergone fairly complete assimilation by the magma. In the reviewer's modified classification the ortho-gneiss is 227′ (a granodiorite-gneiss), the plagioclase-porphyrite is 228 (quartz-diorite porphyry or tonalite-porphyry), four granodiorites are all 227′ (granodiorites in the broad sense, but quartz-monzonites if this group is included in the classification), twelve microcline-quartz-diorites are 227′ (monzotonalites narrow, or granodiorites in the broad sense), three tonalites are 228 (tonalite), a tonalite-gneiss is 227′ (monzotonalite-gneiss), three quartz-diorites are 228 (tonalite), a quartz-diorite is 328 (mela-tonalite), a diorite is 227′ (monzotonalite), two biotite-granites are 227″ (adamellites in the narrow, or granodiorites in the broad sense), an olivine-gabbro is 2312, and two soda-syenites are 2111′ (an albite-monzodiorite in the narrow, or albite-syenodiorite in the broad sense. The latter is the rock to which Laitakari compares his albite-epidote rock which he calls helsinkite. Laitakari's rock is given above in the reviews as 2112, from definition, but he says it may in some cases have a little microcline. The present rocks contain enough microcline,one 11 and one 7 per cent, to throw them into the next family.)